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Discrimination, domestic violence, abuse, and other adverse life events in people with epilepsy: Population-based study to assess the burden of these events and their contribution to psychopathology

Victoria Nimmo-Smith^{1,5}, Traolach S Brugha², Michael P Kerr³, Sally McManus⁴, Dheeraj Rai^{1,5}

1 Avon & Wiltshire Partnership NHS Mental Health Trust, Bristol, UK

2 Department of Health Sciences, University of Leicester, Leicester, UK

3 Institute of Psychological Medicine and Clinical Neurosciences, Cardiff University School of Medicine, Cardiff, UK

4 NatCen Social Research, London, UK

5 Centre for Academic Mental Health, School of Social and Community Medicine, University of Bristol, Bristol, UK

Correspondence: Dr Dheeraj Rai, Centre for Academic Mental Health, School of Social and Community Medicine, University of Bristol, Bristol, BS8 2BN, UK
dheeraj.raai@bristol.ac.uk

Keywords: Seizures; Neuropsychiatry; Epidemiology; Depression; Anxiety; Psychosocial adversity

Summary

Purpose: To quantify the experience of discrimination, domestic violence, abuse and other stressful life events in people with epilepsy in comparison with the general population and people with other chronic conditions. To assess whether any excess relative burden of these adversities could explain the higher rates of depression in people with epilepsy.

Methods: The Adult Psychiatric Morbidity Survey 2007 used comprehensive interviews with 7403 individuals living in private residences in England. Doctor diagnosed epilepsy and other chronic conditions were established by self-report. Discrimination, domestic violence, physical and sexual abuse, and other stressful life events were assessed using computerised self-completion and a face to face interview respectively.

Results: People with epilepsy were seven-fold more likely to have reported experiencing discrimination due to health problems (adjusted OR=7.1; 95% CI=3.1 - 16.3), than the general population without epilepsy. This estimate was substantially greater in people with epilepsy than for people with other chronic conditions. People with epilepsy also had greater odds of experiencing domestic violence and sexual abuse than the general population, although these associations were also found in people with other chronic conditions. There was less evidence of an association between epilepsy and a history of physical abuse or having a greater burden of other stressful life events. In exploratory analyses, assuming they lie on the causal pathway, discrimination, domestic violence and sexual abuse explained 42.7% of the total effect of the relationship between epilepsy and depression or anxiety disorders.

Significance: People with epilepsy can face a range of psychosocial adversities and extensively report feeling discriminated against as compared to the general population. In addition, if confirmed in longitudinal studies, the results suggest that these psychosocial adversities may have a significant role in the development of psychiatric comorbidity and may be targets for future interventions.

Keywords: Seizures; Neuropsychiatry; Epidemiology; Depression; Anxiety; Psychosocial adversity

Key points:

- People with epilepsy were 7-fold more likely to report experiencing discrimination due to physical health problems than the general population.
- People with epilepsy had greater odds of reporting domestic violence and sexual abuse than the general population.
- These psychosocial adversities could explain a substantial proportion of the total effect of the relationship between epilepsy and common mental disorders.

Introduction

Epilepsy is the most common serious neurological disorder globally, with an estimated prevalence of one to two percent in community samples¹. Many people with treated epilepsy can have a condition which is clinically benign but the stigma and discrimination related to the diagnosis has been argued to be worse than the disease itself ^{2,3}. People with epilepsy are more likely to suffer from common mental

disorders such as depression and anxiety disorders than the general population^{4,5} and than people with other chronic conditions⁴. Although this excess psychiatric comorbidity may be related to common neurobiological factors, psychosocial factors may also be important⁶. Discrimination⁷, domestic violence⁸, physical or sexual abuse⁹, and stressful life events¹⁰ are all known to contribute to depression. These psychosocial adversities have also been reported in people with epilepsy but have not been adequately investigated in population based studies.

Previous studies exploring the experience of discrimination in people with epilepsy have either recruited from a secondary care setting or through epilepsy support groups, which may bias results towards the experience of those with more severe epilepsy or who are finding living with epilepsy the most challenging¹¹⁻¹⁴. In these studies the experience of discrimination was reported in 44% to 56% of people with epilepsy^{12,13}. The few community based studies on this topic also found that up to half of people with epilepsy reported experiences of unfair treatment as a result of their epilepsy^{15,16} but did not include a control population.

There is some evidence to support high rates of domestic violence in people with neurological conditions¹⁷ but there is little information on this topic in relation to people with epilepsy¹⁸. The only community based study of the experience of physical or sexual abuse in people with epilepsy has come from a study of pregnant mothers in the Norwegian Mother and Child Cohort Study¹⁸. This reported experience of abuse by 22% of women with epilepsy compared to 19% of women with non-epileptic chronic diseases and 15% of women without epilepsy. This study was unable to study men with epilepsy or women who were not pregnant at the

time¹⁸. Other available studies to date have been small and taken from selected secondary care populations without control populations^{19,20}.

The experience of stressful life events has been studied in relation to seizure frequency²¹, epilepsy onset²² and in studies comparing people with epilepsy with people with non-epileptic attack disorder^{19,23-25}. Stressful life events have also been proposed to have an epileptogenic effect in addition to being associated with psychopathology²⁶. However, as these studies were small or did not have controls for comparison, only tentative conclusions were possible.

A better understanding of the relative burden of adverse experiences such as discrimination, abuse and life events may help provide a more complete picture of the difficulties encountered by people with epilepsy in comparison to the general population. It is important to know whether the burden of these adversities in people with epilepsy is specific to epilepsy or represents the experience of having a chronic illness, and whether it could be hypothesised to explain the excess rates of common mental disorders in epilepsy. Such insights may help inform psychosocial interventions to improve the quality of life and mental health in people with epilepsy.

To address these gaps in the literature, we report findings from a nationally representative sample of adults in England. The aims of our study were i) to quantify the experience of discrimination, domestic violence, abuse and other stressful life events in people with epilepsy ii) to understand the relative burden of these psychosocial adversities in people with epilepsy in comparison with the general population and individuals with other chronic (asthma, diabetes) and neurologic (migraine) conditions; and iii) to assess whether any excess relative burden of these

adversities could explain the higher rates of depression and anxiety disorders in people with epilepsy.

Method

The Adult Psychiatric Morbidity Survey (APMS) 2007

The sample for APMS 2007 was intended to be representative of the population in England over 16 and living in private households²⁷. The study implemented a multistage probability sampling design. The sampling frame was the UK's Royal Mail Small User Postcode Address File, which includes all delivery sites receiving less than 50 pieces of mail every day. The Primary Sampling Units (PSUs) were postcode sectors, which comprised of 2,550 households on average. The PSUs were stratified using Strategic Health Authorities, and by the proportion of people in manual and non-manual socio-economic groupings, then by the proportion of households which own a car from the UK's 2001 Census data. PSUs were then sampled from each stratum with a probability proportional to size (measured by the number of delivery points). There were 519 PSUs identified. Within these PSUs, 28 delivery sites were randomly selected, giving 14532 delivery sites. Small businesses and organisations were excluded once the interviewer had confirmed the address was not a private household, giving 12694 eligible sample addresses. For households comprising more than one adult aged over 16, one adult was randomly selected for interview and 7461 (57%) of individuals agreed to be interviewed. This was made up of 7353 full interviews, 50 partial interviews, and 58 proxy interviews. Excluding the proxy interviews, which were not included in this study, data were used from up to 7,403 productive interviews. Complete documentation of the survey

methodology is available elsewhere²⁷. Ethical approval for the survey was given by the Royal Free Hospital and Medical School Research Ethics Committee.

Epilepsy, asthma, diabetes or migraines

Participants were shown a card with specific health conditions and asked if they had any of the conditions listed. Those stating that they had “epilepsy/fits” since the age of 16 were then asked if a doctor had given them a diagnosis of epilepsy. Epilepsy which started in childhood but persisted into adulthood was included. Comparable questions have been used and found to be valid in other studies of epilepsy in Canada and the United States^{5,28}. A similar methodology was used to identify people reporting a lifetime doctor-diagnosed history of asthma, diabetes and migraines. We have previously studied these conditions in comparison with epilepsy to assess the specificity of co-morbid psychopathology to epilepsy⁴.

Discrimination, domestic violence, sexual abuse and other stressful life events

The experience of discrimination was ascertained using a self-completion tool on a laptop computer during the face to face interview. Self-completion was chosen because it would enable interviewees to feel more comfortable reporting episodes of discrimination²⁹. The questions included perceived unfair treatment in relation to age, sex, ethnicity, religion, sexual orientation, mental health or physical health conditions and were based upon those developed for International Social Justice Project³⁰. In the current study, we specifically studied the responses to the question “Have you been unfairly treated in the last 12 months, because of any other health problem or disability?” which followed an item specific to unfair treatment due to mental health problems.

Domestic violence was assessed using 10 questions based on those asked in the British Crime Survey³¹. These included the current or an ex-partner ever withholding household money from the respondent; preventing them seeing close friends and family; frightening them by threatening to hurt them; pushing, pinning down or slapping them; kicking, biting or hitting with a fist or something else; choking or strangling them; threats or actual use of a weapon or force; and threats to kill the respondent. Subjects were asked to include all relevant events and informed that their answers would not be seen by the interviewer. We defined exposure to domestic violence as an affirmative answer on any one of these questions.

Sexual abuse was assessed using six questions including someone talking to or touching the respondent in a sexual way without consent, or having sexual intercourse without consent since either before or since the age of 16 years and one additional question assessed physical abuse from a parent or step parent before the age of 16 years.

Finally, participants were asked about whether they had ever experienced a range of life events using the List of Threatening experiences scale³² (see appendix Table S1 for a full list of life events included). For the present study, the question regarding the experience of illness was removed as it may bias results if measuring in people with chronic conditions. Two questions regarding violence in the home and sexual abuse were also removed as they were measured by the tools described above. The remaining number of life events were summed to create a life events score. Since the majority of the population reported having experienced life events, we considered the report of 4 or more events to denote the experience of a greater number of life events³³.

Potential confounders

Potential confounders studied included the respondent's age and sex, highest educational qualification (categorised as having i) degree or professional qualification; ii) some qualifications including secondary school educational qualifications; or iii) no qualifications), marital status (married or cohabiting, single or widowed, divorced or separated), employment status (unemployed/economically inactive or employed), tenure of accommodation (owner occupier or renting) ethnicity (white or non-white), quintiles of a small area index of multiple deprivation, and presence of other chronic conditions (reported having no, one, two, or three or more chronic conditions apart from the one under study)⁴. The chronic conditions included a doctor diagnosed history of cancer, diabetes, stroke, hypertension, ischemic heart disease, chronic lung disease, asthma, upper and lower gastrointestinal disease, bladder problems, arthritis and migraines requiring treatment in the preceding 12 months.

Common mental disorders:

Individuals meeting the World Health Organization International Classification of Diseases, Revision 10 (ICD-10) diagnoses of depression and anxiety disorders were identified using the Clinical Interview Schedule-Revised (CIS-R), a structured psychiatric interview administered face-to-face⁴. Our previous work found important associations between epilepsy and depression, phobic and generalised anxiety disorders and with individuals meeting the criteria for any depressive or anxiety disorder⁴. We included these diagnoses in the present study to investigate if their associations with epilepsy could be explained by the psychosocial stressors under study.

Analysis

We conducted analyses using the survey (svy) commands in STATA 13 for Windows (StataCorp LP, College Station, TX, U.S.A.). We used probability weights to account for the complex study design and non-response to ensure the estimates are representative of the population of England²⁷. Complete details of the weighting procedures are available elsewhere^{4,27}. We estimated the weighted prevalence of discrimination, domestic violence, sexual abuse and life events for people with epilepsy. We used weighted logistic regression models to estimate odds ratios (OR) and 95% confidence intervals (95% CI) of the association of discrimination, physical and sexual abuse and life events with epilepsy. We included the variables representing age, sex, marital status, educational qualifications, tenure of accommodation, employment status, ethnicity, index of multiple deprivation, and the presence of other chronic conditions in adjusted models as potential confounders to estimate adjusted ORs and 95% CIs. In comparative analyses, we used an equivalent methodology to estimate associations in people with asthma, diabetes and migraines.

We then assessed the impact of these psychosocial adversities on the association between epilepsy and common mental disorders. We first adjusted for these in models assessing the association between epilepsy and common mental disorders, conceptualising them as potential confounders (see Fig 1). Although the temporal sequencing of the variables was unknown in this cross sectional study, but these variables could be considered to be on the causal pathway between epilepsy and poor mental health (see Fig 1). To quantify the extent of possible mediation, we used the user written *binary_mediation* package in Stata to estimate direct, indirect and

total effects, and the total effect mediated. We used bootstrapping with 1000 replications to calculate the bias corrected confidence intervals for these estimates.

Results

Results of the descriptive analysis, detailing socio-demographic characteristics of people with epilepsy and comparing them with people without epilepsy has been reported previously ⁴ and available as supplementary material (Table S2). For the purpose of this study, complete data was present for 88 people with epilepsy and 6,819 people without epilepsy.

The weighted prevalence of people with epilepsy reporting discrimination due to physical health problems (11%) was significantly greater than that estimated for the general population (1.6%) (Table 1). Following adjustment for potential confounders, people with epilepsy had seven-fold odds of reporting experience of discrimination due to their physical health than the general population without epilepsy (adjusted OR= 7.1; 95% CI=3.1-16.3). In comparison, people with asthma and diabetes had an almost two-fold increase in odds of reporting discrimination but there was no evidence of such associations in people with migraine (Table 2).

Over a third (37%) of people with epilepsy had experienced domestic violence compared to 24% people without epilepsy. After adjusting for potential confounders, the odds of reporting experiencing domestic violence were 60% greater than the general population (adjusted OR=1.6; 95% CI=1.0-2.7). This association was similar to that in people with migraines (adjusted OR=1.5; 95% CI=1.3-1.8) and greater than that observed in people with asthma or diabetes (Table 2).

About one in ten people with epilepsy reported having experienced physical abuse, compared to 4.6% reported by the general population (adjusted OR= 1.9; 95% CI=0.9–4.2). The confidence intervals for this association crossed one but the point estimate was comparable to people with migraines, where over 7% had reported experiencing physical abuse (adjusted OR=1.8; 95% CI=1.3–2.5). There was no significant association between the chronic conditions asthma and diabetes and physical abuse (Table 2).

A third (34.0%) of people with epilepsy had reported experiencing some form of sexual abuse compared to a fifth (20.8%) of the general population (adjusted OR=2.0; 95% CI=1.3– 3.3). The odds of experiencing sexual abuse were also greater in people with asthma (adjusted OR=1.5; 95% CI=1.3–1.8) and migraines (adjusted OR=1.5; 95% CI=1.3–1.8).

A greater proportion of people with epilepsy (42.6%) reported having experienced four or more adverse life events than the general population (34.6%) although this difference was not statistically significant (adjusted OR=1.4; 95% CI=0.9-2.3). This result was comparable to people with asthma (adjusted OR= 1.3; 95% CI=1.1-1.5) and people with migraines (1.7; 95% CI=1.4–2.0).

Table 3 shows the results of the associations between epilepsy and common mental disorders before and after additional adjustment for discrimination, domestic violence and sexual abuse. Following adjustment with these variables, there was a substantial attenuation of the odds ratios for depression and anxiety disorders, although the relationship between epilepsy and depression still remained statistically significant (Table 3). If these variables were assumed to be on the causal pathway, we estimated in an exploratory mediation model, that they would explain 42.7% of

the total effect between epilepsy and common mental disorders (including depression, all anxiety disorders and mixed anxiety and depression); 25% of the total effect between epilepsy and depression and 28.1% of the total effect between epilepsy and phobic or generalised anxiety disorders (Fig 2, Table 4).

Discussion

In this population-based study, designed to be representative of the population of England, people with epilepsy were seven-fold more likely to have reported experiencing discrimination due to health problems, compared to the general population without epilepsy. This estimate was substantially greater in people with epilepsy than for people with other chronic conditions. People with epilepsy also had greater odds of experiencing domestic violence and sexual abuse than the general population, although these associations were also found in people with other chronic conditions. There was less evidence for a relationship between epilepsy and physical abuse before age 16 or having an excess of other adverse life events. If a causal pathway were assumed, discrimination, domestic violence and sexual abuse could explain a substantial proportion of the total effect of the relationship between epilepsy and depression and anxiety disorders.

Strengths and limitations

To our knowledge this is the only population based study describing the experience of discrimination, domestic violence, abuse and other stressful life events in epilepsy using general population controls and accounting for a range of relevant confounders. In addition, the ability to compare our results with the prevalence of

these experiences in people with other chronic conditions offer a significant advantage towards understanding the specificity of these associations to epilepsy.

There are several limitations to this study. Although the sample was large, the number of people with epilepsy was comparatively low which resulted in wide confidence intervals for some associations. We were unable to study risk in specific subgroups such as women since the numbers would be insufficient to provide meaningful estimates. Only 57% of the sample who were eligible for interview responded in the APMS and so weighting procedures were used to reduce the likelihood of non-response bias²⁷. Because epilepsy was self-reported in this survey we were unable to prevent the possibility of reporting bias. There was no data on the seizure type or frequency. It is possible that some individuals reporting having had the diagnosis of epilepsy actually have a different diagnosis, such as Non Epileptic Attack Disorder. However, the potential for such misclassification exists in almost all large scale epidemiological studies of epilepsy which routinely use self-reported measures of epilepsy^{5,15}. This study measured perceived experience of discrimination due to health problems, with no corroborative objective information. Whilst such measures are widely used,^{12,13} it is not possible to delineate episodes of discrimination from legitimate restrictions (such as restrictions on driving), which may have been placed on individuals due to the nature of their health problems. Also, the possibility of selective recall cannot be ruled out. For instance, it is possible that people with epilepsy have more negative recollections than the general population due to psychiatric comorbidities, or the cognitive or behavioural side effects of medications. Finally, the cross-sectional design limits any inferences of causation or directionality.

Our study builds on the findings of previous studies reporting high rates of discrimination or unfair treatment experienced by people with epilepsy^{15,16}. It adds that epilepsy has a specific and stronger relationship with the experience of discrimination compared to the general population and other chronic conditions. It has been widely documented that misperceptions about epilepsy have persisted in society throughout history and perpetuated in popular culture, resulting in stigma and social isolation. Despite improvements in our understanding of epilepsy over the last century, negative attitudes towards epilepsy continue to persist³. For example, contemporary studies of attitudes towards epilepsy continue to report high rates of individuals stating that they would object to their child marrying someone with epilepsy³⁴⁻³⁶, or that people with epilepsy should not be employed as a nurse or teacher irrespective of type and frequency of seizures³⁷. In the U.K., over 50% of 1,600 randomly selected informants agreed that people with epilepsy are treated differently, including by social avoidance and exclusion. They attributed this partially to fears about people with epilepsy being 'unreliable' and 'abnormal'³⁸. The prevalence of negative attitudes is sufficient to indicate that people with epilepsy are likely to have experienced them through enacted stigma, which refers to episodes of actual discrimination³⁹.

Our study adds substantially to the literature on the experience of other psychosocial stressors in epilepsy including domestic violence, physical and sexual abuse, and other stressful life events in people with epilepsy. Previous work exploring these has been largely focused on selected populations with limited generalisability¹⁸⁻²⁰. There is some evidence that the experience of discrimination and of violence may interact. For example, abuse from others has been studied in people with refractory epilepsy

and learning disability, and in this population, discrimination due to health problems was experienced by 91%, and over half of the respondents reported having been threatened or attacked because of their health problems¹⁴. This could suggest that abuse follows the diagnosis of epilepsy and forms part of the experience of discrimination. On the other hand, stressors and life events may be considered to have an epileptogenic effect⁴⁰. Previous literature has also explored abuse in relation to people with non-epileptic attack disorder^{20,23-25} and some people assessed as having epilepsy in our study may actually have this alternative diagnosis.

In exploratory mediation analyses, we attempted to understand the potential contribution of these psychosocial adversities on the well known excess burden of common mental disorders in people with epilepsy. Our findings suggest that a substantial proportion of the relationship between epilepsy and common mental disorders could be explained by the experience of discrimination, domestic violence and sexual abuse. However, it is important to note that making directional and causal inference is difficult in cross sectional studies and various explanations may be possible. For instance, these psychosocial stressors may be on the causal pathway between epilepsy and common mental disorders, or be confounders of the relationship. Finally, individuals with depression, anxiety, and both depression and anxiety disorders, might be more likely to recall or report memories of stressors (Fig 1). These questions can only be answered by well designed longitudinal studies.

Implications

Our study demonstrates that people with epilepsy face a range of psychosocial adversities and extensively report feeling discriminated against, even in a developed

society such as England. The causal pathways between epilepsy, psychosocial stressors and mental disorders need to be investigated in longitudinal studies. Such information may lead to interventions that have the potential to reduce the burden of common mental disorders in people with epilepsy and improved quality of life. Continued efforts are needed to develop and evaluate interventions to reduce epilepsy-related discrimination. Finally, epilepsy clinicians should consider that patient histories may also have episodes of trauma or abuse and need to be aware of how to refer individuals to support agencies or further treatment.

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Contributions: a) All co-authors have been substantively involved in the study and/or the preparation of the manuscript; b) no undisclosed groups or persons have had a primary role in the study and/or in manuscript preparation (i.e., there are no "ghost-writers"); and c) all co-authors have seen and approved the submitted version of the paper and accept responsibility for its content. Specific contributions: VNS

carried out literature reviews, helped interpret results and drafted the paper; DR had the research idea, carried out the analysis, helped interpret the results and helped VNS draft the paper; MK, SM, and TSB edited successive versions of the manuscript. SM and TSB also made important contributions to the design and conduct of the parent APMS survey.

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Table 1. Weighted prevalence of discrimination, abuse and other stressful life events in people with epilepsy, and results of logistic regression analysis comparing prevalence in people with epilepsy with the general population of England without epilepsy

	Prevalence in people with epilepsy (n=88) % (95%CI)	Prevalence in general population without epilepsy (n=6819) %(95%CI)	Crude OR (CI)	Adjusted OR (CI)
Discrimination due to physical health problem	11.0 (5.4- 21.2)	1.6 (1.3 – 1.9)	7.7 (3.4 -17.2)***	7.1 (3.1 – 16.3)***
Domestic violence	37.0 (26.6- 48.8)	23.9 (22.7- 25.1)	1.9 (1.1-3.1)*	1.6 (1.0-2.7)
Sexual abuse	34.0 (24.1- 45.4)	20.8 (19.7- 21.8)	2.0 (1.2-3.2)**	2.0 (1.3-3.3)**
Physical abuse	9.2 (4.6- 17.7)	4.6 (4.0- 5.2)	2.1 (1.0- 4.5)	1.9 (0.9- 4.2)
Life events (4 or more)	42.6 (31.6- 54.4)	34.6 (33.2- 36.0)	1.4 (0.9- 2.3)	1.4 (0.9- 2.3)
<p>Notes</p> <p>OR=Odds Ratio, CI=95% Confidence intervals.</p> <p>*p<0.05. **p<0.01. ***p<0.001</p> <p>Adjusted OR = model adjusted for age, sex, marital status, highest educational qualification, employment status, tenure of accommodation, ethnicity, quintiles of index of multiple deprivation, and number of comorbid physical illnesses.</p> <p>N's refer to actual numbers, all percentages are weighted to account for the complex study design and non-response to ensure the estimates are representative of the population of England</p>				

Table 2. Logistic regression analysis of associations of discrimination, abuse and other stressful life events in people with asthma, diabetes and migraine or chronic headaches as compared to the general population of England (without asthma, diabetes or migraines respectively)

	ASTHMA (n =854)		DIABETES (n = 388)		MIGRAINE (n = 911)	
	Prevalence (95% CI)	Adjusted OR (95% CI)	Prevalence (95% CI)	Adjusted OR (95% CI)	Prevalence (95% CI)	Adjusted OR (95% CI)
Discrimination	3.6 (2.4- 5.5)	2.0 (1.2 -3.4)*	3.6 (2.1- 6.1)	2.1 (1.1 -3.7)*	2.4 (1.6- 3.7)	1.1 (0.7 – 1.9)
Domestic violence	29.4 (26.2 - 32.9)	1.2 (1.0-1.5)*	19.5 (15.5- 24.3)	1.0 (0.7-1.3)	34.1 (30.7- 37.6)	1.5 (1.3-1.8)***
Sexual abuse	28.6 (25.5-32.3)	1.5 (1.3-1.8)***	14.8 (11.4-18.9)	0.8 (0.6- 1.2)	30.5 (27.3- 33.8)	1.5 (1.3- 1.8)***
Physical abuse	5.9 (4.4-7.9)	1.2 (0.9- 1.7)	5.8 (3.8- 8.6)	1.0 (0.6- 1.6)	7.2 (5.7- 9.2)	1.8 (1.3- 2.5)***
Life events (4 or more)	39.1 (35.7- 42.6)	1.3 (1.1- 1.5)**	38.8 (33.4- 44.6)	1.0 (0.8- 1.3)	43.6 (39.8- 47.3)	1.7 (1.4- 2.0)***

Notes:

OR=Odds Ratio, 95% CI=95% Confidence intervals.

*p<0.05. **p<0.01. ***p<0.001

Adjusted OR= model adjusted for age, sex, marital status, highest educational qualification, employment status, tenure of accommodation, ethnicity, quintiles of index of multiple deprivation, and number of comorbid physical illnesses.

N's refer to actual numbers, percentages are weighted to account for the complex study design and non-response to ensure the estimates are representative of the population of England

Table 3. Effect of adjustment for discrimination, domestic violence and sexual abuse on the association between epilepsy and common mental disorders

	Model 1	Model 2
Depression or anxiety disorder	2.0 (1.2-3.4)**	1.5 (0.8 – 2.6)
Depression	3.1 (1.6-6.2)**	2.1 (1.0-4.3)*
Phobic or generalised anxiety disorders	2.3 (1.3 -4.2)*	1.7 (0.9-3.3)
OR=Odds Ratio, CI=95% Confidence intervals.		
*p<0.05 **p<0.01 ***p<0.001		
Model 1= adjusted for age, sex, marital status, highest educational qualification, employment status, tenure of accommodation, ethnicity, quintiles of index of multiple deprivation, and number of comorbid physical illnesses.		
Model 2= model 1 adjusted for discrimination, domestic violence, sexual abuse		

Table 4. Exploratory mediation analysis of the association between epilepsy and common mental disorders by discrimination, domestic violence and sexual abuse

Path	Any depressive or anxiety disorder	Depressive disorder	Phobic or generalised anxiety disorder
	Coefficient *	Coefficient *	Coefficient *
	(Bias corrected 95% CI)	(Bias corrected 95% CI)	(Bias corrected 95% CI)
Total effect	0.046 (0.023-0.067)	0.070 (0.040-0.099)	0.057 (0.021-0.079)
Direct effect	0.027 (0.005-0.047)	0.053 (0.021-0.079)	0.41 (0.005-0.063)
Total Indirect effect	0.020 (0.013-0.026)	0.018 (0.012-0.023)	0.016 (0.010-0.022)
<i>Discrimination</i>	0.009 (0.005-0.013)	0.008 (0.004-0.012)	0.006 (0.003-0.009)
<i>Domestic violence</i>	0.005 (0.001-0.009)	0.003 (0.001-0.007)	0.005 (0.001-0.009)
<i>Sexual abuse</i>	0.006 (0.003-0.008)	0.006 (0.003-0.010)	0.005 (0.003-0.008)
Proportion of total effect mediated by all three mediators above(%)	42.7%	25.0%	28.1%
<p>*Bias corrected 95% CI= 95% Confidence intervals obtained by bootstrapping with 1000 replications.</p> <p>Coefficients adjusted for age, sex, marital status, highest educational qualification, employment status, tenure of accommodation, ethnicity, quintiles of index of multiple deprivation, and number of comorbid physical illnesses.</p> <p>Model assumes discrimination, domestic violence and sexual abuse lie on the causal pathway between epilepsy and psychopathology</p>			

FIGURE LEGENDS.

Figure 1. Three models for the potential role of psychosocial stressors in the relationship between epilepsy and common mental disorders

A= considers psychosocial stressors as a mediator of the relationship

B= considers psychosocial stressors as a confounder of the relationship

C=considers reverse causality including recall or reporting bias in people with common mental disorders

Figure 2. Exploratory mediation model of the association between epilepsy and common mental disorders by the experience of discrimination, domestic violence and sexual abuse.

Notes: a) indirect effect b) direct effect c) total effect. Numbers are coefficients (bias corrected 95% confidence intervals) for each path. The models are adjusted age, sex, marital status, highest educational qualification, employment status, ethnicity, quintiles of index of multiple deprivation, and number of comorbid physical illnesses.

Supplementary data:

Table S1. Life events covered by items in the List of Threatening experiences scale

1. Serious illness, injury or assault to yourself.
2. Serious illness, injury or assault to a close relative
3. Death of an immediate family member of yours
4. Death of a close family friend or other relative, like an Aunt, cousin or grandparent
5. Separation due to marital difficulties, divorce or steady relationship broken down
6. Serious problem with a close friend, neighbour or relative
7. Being made redundant or sacked from your job
8. Looking for work without success for more than 1 month
9. Major financial crisis, like losing the equivalent of 3 months income
10. Problem with police involving court appearance
11. Something you valued being lost or stolen
12. Bullying
13. Violence at work
14. Violence in the home
15. Sexual abuse
16. Being expelled from school
17. Running away from your home
18. Being homeless

Note: Items 1, 14 and 15 were not included in the calculation of the life events score

Table S2. Descriptive characteristics of people with epilepsy, asthma, diabetes, migraines and the overall APMS sample.

	Overall APMS Sample	Epilepsy	Asthma	Diabetes	Migraine
	(n=6913)	(n=88)	(n = 854)	(n = 388)	(n = 911)
	%	%	%	%	%
Age					
16-34 years	30.0	31.2	35.7	4.1	29.3
35-54 years	36.4	46.3	33.7	23.1	39.0
55 years or more	33.6	22.5	30.5	72.8	31.7
Gender					
Female	52.0	52.3	55.8	47.0	73.5
Ethnicity					
White	90.9	98.0	92.6	89.0	92.3
Marital status					
Married/Cohabiting	64.6	56.5	59.1	66.9	68.3
Single/Widowed	27.9	31.7	32.6	23.0	21.4
Divorced/Separated	7.5	11.8	8.3	10.1	10.3
Quintiles of the small area level index of multiple deprivation					
1 st (Least deprived)	19.2	24.1	17.4	15.7	18.8
2 nd	22.2	13.3	20.6	17.1	21.2
3 rd	20.1	15.6	21.2	21.8	18.9
4 th	19.0	21.1	20.4	20.4	18.8
5 th (Most deprived)	19.5	26.0	20.4	25.0	22.4
Employment					
Economically inactive	38.2	46.8	41.6	65.9	41.1
Highest educational qualification					
Degree level	28.3	22.9	27.6	18.4	25.4
A/O Level (or GCSEs)	45.9	44.7	44.7	31.2	50.4
No qualifications	25.8	32.4	27.6	50.4	24.2
Tenure of accommodation					
Owner-occupied	71.1	57.4	64.1	68.7	69.5
Number of other physical illnesses					
0	49.2	53.0	47.9	24.4	43.2
1	29.4	23.4	26.6	28.4	31.2
2 or more	21.5	23.6	25.5	47.3	25.6

Note: N's refer to actual numbers, percentages are weighted to account for the complex study design and non-response